

Application Serial No. 10/517,771
Reply to Office Action mailed 10/05/06

IN THE DRAWINGS

The attached sheets of drawings include changes to Figs. 1 and 2. These sheets, which include Figs. 1 and 2, replace the original sheets including Figs. 1 and 2.

Attachment: Replacement Sheets

REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-5, 7-13, 15, 16, and 18-22 are presently active in this case, Claims 1, 7, 9, 11, 12, 15, 16, 18, 20, and 22 having been amended and Claims 6, 14, and 17 having been canceled without prejudice or disclaimer by way of the present Amendment.

In the outstanding Official Action, the drawings were objected to because of several informalities. Submitted concurrently herewith are Replacement Sheets that include changes to Figures 1 and 2 to address the objections regarding the legends in Figures 1 and 2, and the misspelling in Figure 2. The drawings were objected to under 37 CFR 1.83(a) for not showing all of the features of the claims. The Applicants note that Figure 3 depicts an embodiment of the electrode recited in claim 1, as indicated by reference numeral 2. (See also, Figure 9.) The recitation of the heater has been canceled without any prejudice or disclaimer of such a feature. Regarding the recitations in Claims 9-11 and 20-22, the Applicants submit that the sensor as a structural component of such systems recited therein are clearly depicted in the figures, for example, Figures 3 and 4. Thus, the Applicants submit that the recited features are depicted, and respectfully request the withdrawal of the objection to the drawings with respect to the recitations in Claims 9-11 and 20-22. Accordingly, the Applicants request the withdrawal of all of the objections to the drawings.

Claims 7-11 and 15-22 were objected to under 37 CFR 1.75(c) as being in improper multiple dependent form. The claims have been amended to remove all improper multiple dependent recitations. No pending multiple dependent claim depends from a multiple dependent claim, and each multiple dependent claim uses terminology identified as being

acceptable in MPEP 608.01(n). Accordingly, the Applicants respectfully request the withdrawal of the objection to the Claims 7-11 and 15-22.

Claims 1-6, 14, and 15 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 has been amended to change “the oxygen partial pressure” to “an oxygen partial pressure,” thereby providing proper antecedent basis to this limitation. The term “wherein” in line 2 of Claim 1 has been changed to “comprising” as suggested. The phrase “said temperature compensation unit is composed of an oxygen ion conductor” in line 9 of Claim 1 has been changed to “said conductor is an oxygen ion conductor” in order to clarify this recitation. Additionally, the formula noted in previously pending Claim 14, which has been incorporated into Claim 12, has been removed, thereby clarifying the proportional relationship recited therein. The Applicants note that the symbol previously used represents that a proportionality exists between the left side of the formula and the right side of the formula. Accordingly, the Applicants submit that the pending claims are definite and therefore request the withdrawal of the indefiniteness rejections.

Claim 14 was indicated on page 5 of the Official Action as being allowable if rewritten in independent form and amended to overcome the indefiniteness rejection thereof. As noted above, the Applicants submit that the indefiniteness rejection of the subject matter of previously pending Claim 14 has been overcome, and the subject matter has been incorporated into independent base Claim 12. Thus, independent Claim 12 and all of the claims that depend therefrom are in condition for allowance, and the remaining rejections thereof are moot.

Claims 1 and 6 were rejected under 35 U.S.C. 102(b) as being anticipated by Brothers et al. (U.S. Patent No. 4,659,435). Claims 2 and 3 were rejected under 35 U.S.C. 103(a) as being unpatentable over Brothers et al. in view of Kubo (U.S. Patent No. 4,519,237). Claims

4 and 5 were rejected under 35 U.S.C. 103(a) as being unpatentable over Brothers et al. in view of Tien et al. (U.S. Patent No. 4,387,359). For the reasons discussed below, the Applicants traverse the above art rejections.

In the Office Action, the Brothers et al. reference is indicated as anticipating independent Claim 1. However, the Applicants note that a claim is anticipated only if each and every element as set forth in the claims is found, either expressly or inherently described, in a single prior art reference. As will be demonstrated below, the Brothers et al. reference clearly does not meet each and every limitation of independent Claim 1.

Claim 1 of the present application recites a resistance-type oxygen sensor with suppressed temperature dependence, comprising: (1) a gas detection unit composed of an oxide semiconductor with a resistance value varying according to temperature and an oxygen partial pressure of atmospheric gas and a temperature compensation unit composed of a conductor with suppressed dependence of a resistance value on oxygen partial pressure are connected in series; (2) said conductor is an oxygen ion conductor; and (3) an electrode for electric contact with said temperature compensation unit is exposed to the atmospheric gas and is a porous body. The Applicants submit that the Brothers et al. reference fails to disclose all of the above limitations.

The Brothers et al. reference describes an electrochemical cell including a solid electrolyte heated to an elevated temperature for operation and an integral cell electrode/heater for heating the electrolyte. The integral electrode/heater is applied to a surface of the solid electrolyte and is resistively heated by an alternating electric current. The cells can be incorporated into an oxygen detector where the apparatus is operated by alternately heating the cell and measuring the emf developed by the cell across its electrode.

The Applicants note that the technology in the Brothers et al. reference does not relate to a resistance-type oxygen sensor, as in the present invention, but rather relates to an

electromotive oxygen sensor. An electromotive oxygen sensor can also be referred to as an electrochemical cell.

An electromotive oxygen sensor, such as that in the Brothers et al. reference, uses an oxygen ion conductor made from zirconium oxide or the like. For example, in the case of zirconium oxide in the form of a plate, electrodes are provided on front and back surfaces, and electromotive force is generated arising from the difference in oxygen partial pressure on the front and back surfaces when heat is applied to the thermal region that forms the oxygen ion conductor. If the oxygen partial pressure on one surface is already known, then the oxygen partial pressure on the other side can be measured. (See, e.g., column 1, lines 20-47, of the Brothers et al. reference.)

In a resistance-type oxygen sensor, the electrical resistance of the gas detection material varies in accordance with the oxygen partial pressure. A sensor that uses this principle does not, and cannot in any way, generate electromotive force. Also, a reference electrode is not needed.

In this manner, a resistance-type oxygen sensor and an electromotive oxygen sensor (or electrochemical cell) measure oxygen partial pressure using completely different principles, and thus the technology in the present invention is completely different from the technology of the electrochemical cell in the Brothers et al. reference.

Turning now to the merits of the anticipation rejection of Claim 1 set forth in the Official Action, the Applicants note that Claim 1 recites “a gas detection unit.” Such a feature is not disclosed in the Brothers et al. reference. The Official Action equates the thermocouple (39) of the Brothers et al. reference with the “gas detection unit” of the present invention, which the Applicants submit is an unreasonable and improper interpretation of this feature. The Official Action cites to Figure 2a and column 13, lines 46-61, for the teaching of “a gas detection unit or thermocouple 39;” however, these portions of the Brothers et al.

reference do not mention a “gas detection unit” or any device that could be used to as a gas detection unit. The Applicants note that column 11, lines 21-24, clearly indicates that the thermocouple (39) is configured to act as a temperature sensing device, rather than as a device that can detect gas. Furthermore, the thermocouple (39) is not even exposed to the gas in the flue (24), as is evident from a review of Figures 2 and 2a, and column 11, lines 32-36, which notes that the inner electrode layer (36) is a reference electrode to which ambient air is supplied. Thus, the Brothers et al. reference fails to disclose “a gas detection unit” as recited in Claim 1.

Additionally, the Applicants note that Claim 1 recites a gas detection unit “composed of an oxide semiconductor.” Such a feature is not disclosed in the Brothers et al. reference. The Official Action equates “alumina bores” of the Brothers et al. reference with the “oxide semiconductor” of the present invention, which the Applicants submit is an unreasonable and improper interpretation of this feature. The Official Action cites to column 13, lines 46-61, for the teaching of two bores of alumina tube (100) containing leads (40 and 41) forming the thermocouple (39), where Chromel-P or Alumel leads can be used. This portion of the Brother et al. reference does not disclose the oxide semiconductor of the present invention. Alumina is generally an insulator and is not an oxide semiconductor. No disclosure or suggestion is given in column 13, lines 46-61, that “alumina” is an oxide semiconductor. Furthermore, Chromel and Alumel are not oxides, but rather are metals. Thus, the Brothers et al. reference fails to disclose a gas detection unit “composed of an oxide semiconductor” as recited in Claim 1.

Furthermore, the Applicants note that Claim 1 recites a gas detection unit and a temperature compensation unit “connected in series.” Such a feature is not disclosed in the Brothers et al. reference. The Official Action equates features (30) and (43) of the Brothers et al. reference with the “temperature compensation unit” of the present invention, and

thermocouple (39) with the “gas detection unit.” However, tubular electrochemical sensor cell (30) and temperature compensator circuit (43) are not connected as an electrical series circuit, as is self-evident from Figure 1. Additionally, while thermocouple (39) and temperature compensator circuit (43) are in electrical contact, this contact is only for the purpose of compensating for the voltage of the thermocouple (39) at the temperature compensator circuit (43), and it cannot be said that this electrical contact is equivalent to the series connection in the present invention. Thus, the Brothers et al. reference fails to disclose the series connection recited in Claim 1.

Thus, the present invention clearly recites numerous features that are not disclosed by the Brothers et al. reference. In fact, the present invention and the electrochemical cell described in the Brothers et al. reference are completely distinct technologies. The Applicants respectfully request the withdrawal of the anticipation rejection of independent Claim 1, since the Brothers et al. reference fails to disclose all of the limitations recited therein.

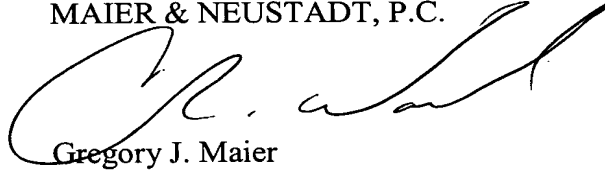
The claims that depend from Claim 1 are considered allowable for the reasons advanced for Claim 1. These claims are further considered allowable as they recite other features of the invention that are neither disclosed nor suggested by the applied references when those features are considered within the context of Claim 1.

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Consequently, in view of the above discussion, it is respectfully submitted that the present application is in condition for formal allowance and an early and favorable reconsideration of this application is therefore requested.

Respectfully Submitted,

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A handwritten signature in black ink, appearing to read 'G. Maier', is written over the printed name of Gregory J. Maier.

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